COLORADO RIVER RECOVERY PROGRAM
FY 2006 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: C-6HYD

I. Project Title: Physical evaluation of floodplain habitats restored/enhanced to benefit endangered fishes of the upper Colorado River basin.

II. Principal Investigator(s): Terence L. Stroh, U.S. Bureau of Reclamation, 2764 Compass Drive, Suite 106, Grand Junction, CO 81504, tstroh@uc.usbr.gov, (970)-248-0608, Fax: (970) 248-0601

III. Project Summary: The project is designed to determine, as a function of mainstem flows, how well restored/enhanced floodplain nursery habitats at the Audubon, Unaweep, and Walter Walker sites connect with the river and how likely they are to entrain drifting larvae. Restored/enhanced floodplain habitats are being evaluated to characterize post-runoff habitat and levee-breach morphology. Projection of when the downstream levee will be breached by the Colorado River at the Grand Junction Pipe site is also being evaluated. Potential problems and recommendations associated with the restored/enhanced floodplain habitats will also be identified.

IV. Study Schedule: *[2006-2007.]*

V. Relationship to RIPRAP:

COLORADO RIVER ACTION PLAN: MAINSTEM
ACTIVITY II. RESTORE HABITAT
II.A. Restore and manage flooded bottomland habitat.
II.A.6. Develop and implement Colorado River Sub-basin Floodplain Management Plan.
COLORADO RIVER ACTION PLAN: GUNNISON RIVER
ACTIVITY II. RESTORE HABITAT
II.A. Restore and manage flooded bottomland habitat.
II.A.6. Develop and implement Colorado River Sub-basin Floodplain Management Plan.

VI. Accomplishment of FY 2006 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings: In the spring of 2006, monuments were established and baseline topography data was collected on the lowered levees at the Audubon, Unaweep and Walter Walker sites. Post-runoff topography data was also collected at each site to determine the volume of deposition or erosion. Each site was visited during periods when there were connecting flows. Photos and cross-sectional flow measurements were taken to estimate flow rates entering the floodplain habitats during river connection.

Pre- and post-runoff topography data was also collected at the Grand Junction Pipe site to estimate the rate of erosion and when the existing levee may be breached by the river. Because of limited spring peak flows, only two stream flow measurements were taken. Photos of river connections and daily streamflow data for each site are attached. A summary of the collected data is as follows:

Colorado River	**Design Connection**	**Actual Observed Connection**	**Days of Connection**
Audubon Site	16,700 cfs	18,000 cfs	3 days (5/23 to 5/25)
Walter Walker Site	13,600 cfs	13,600 cfs	13 days (5/17 to 5/29)
Gunnison River			
Unaweep Site	4,200 cfs	3,700 cfs	22 days (4/14 to 4/19) (4/23 to 4/30) (5/4) (5/16 to 5/18) (5/21 to 5/24)

1) On May 19, 2006, 168 cfs was measured flowing over the lowered levee at the Walter Walker Site when Colorado River flows at the Stateline gage were 14,400 cfs. At flows greater than 14,400 cfs, it becomes impractical and unsafe to measure flows over the lowered levee.
2) On May 22, 2006, 9 cfs was measured flowing through the constructed levee notch at the Audubon Site when Colorado River flows at the Stateline gage were 21,900 cfs. Connecting flows lasted for only 3 days, and additional measurements were not made.
3) Flow measurements at the Unaweep site were not collected because flows through the notch were less than 3" in depth as shown in the site photo.
4) Volumetric changes for the Walter Walker and Audubon sites were computed using an average grid, composite, and end-area cross section methods. The Walter Walker levee showed an average loss (erosion) of 20 cubic yards and the Audubon levee showed and average gain (deposition) of 6 cubic yards. Survey data is on file at the Bureau of Reclamation's Western Colorado Area Office in Grand Junction, Colorado.

VII. Recommendations: River connections with restored/enhanced floodplain habitats were minimal in 2006 because of lower spring peak flows. The Colorado River peaked at 20,900 cfs at the USGS Colorado River at Stateline gage and the Gunnison River peaked at 5,060 cfs at the USGS Gunnison River near Grand Junction gage. Because of the low volume spring peak, especially on the Gunnison River, it is recommended that additional survey data be collected during 2007 spring runoff to obtain three flow measurements per site during connection flows. It is also recommended that additional topography data be collected at each site after the 2007 spring runoff to assist in the evaluation the erosion/deposition and integrity of the restored/enhanced floodplain habitat.

VIII. Project Status: Completion in 2007

IX. FY 2006 Budget Status

A. Funds Provided: $20,000.00
B. Funds Expended: *[Please identify funds <u>expended</u>, not just those obligated.]*
C. Difference: *[Include an explanation for any major difference.]*
D. Percent of the FY 2006 work completed, and projected costs to complete: *[For projects funded by the Bureau of Reclamation.]*
E. Recovery Program funds spent for publication charges:

X. Status of Data Submission (Where applicable): Collected data will be included in the Final Report prepared and submitted in 2007.

XI. Signed: /s/ *Terry L. Stroh* November 2, 2006
Principal Investigator Date
Terence L. Stroh, General Biologist
U.S. Bureau of Reclamation, Grand Junction, CO

APPENDIX: Site Photos
Walter Walker Site (5/18/2006)
Walter Walker Site (5/23/2006)
Audubon Site (5/18/2006)
Audubon Site (5/24/2006)
Audubon Site (5/25/2006)
Unaweep Site (5/22/2006)
USGS 2006 Avg. Daily Spring Peak Flows
Colorado River
Gunnison River
Walter Walker River Connection Discharge Measurements
Audubon River Connection Discharge Measurements
Colorado River Avg. Daily Spring Peak Flows (1951-2006)
Gunnison River Avg. Daily Spring Peak Flows (1897-2006)

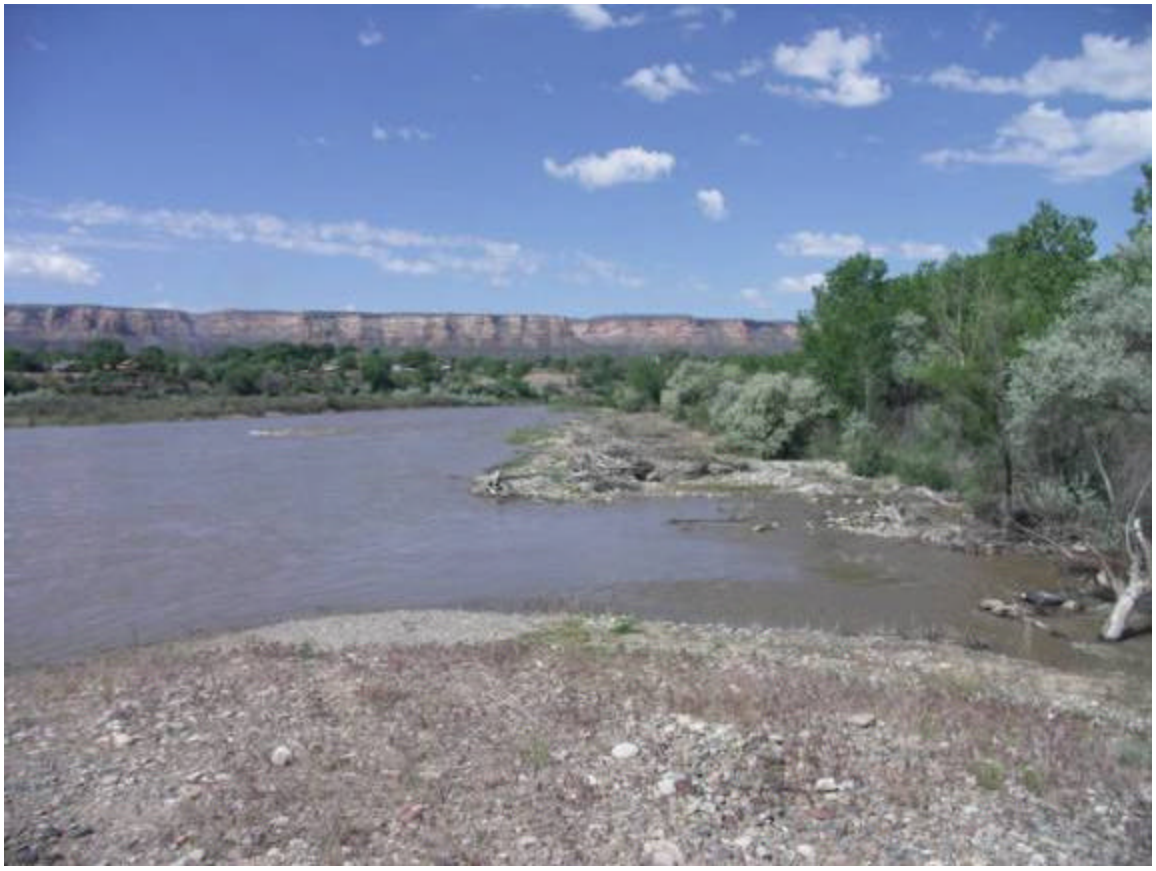
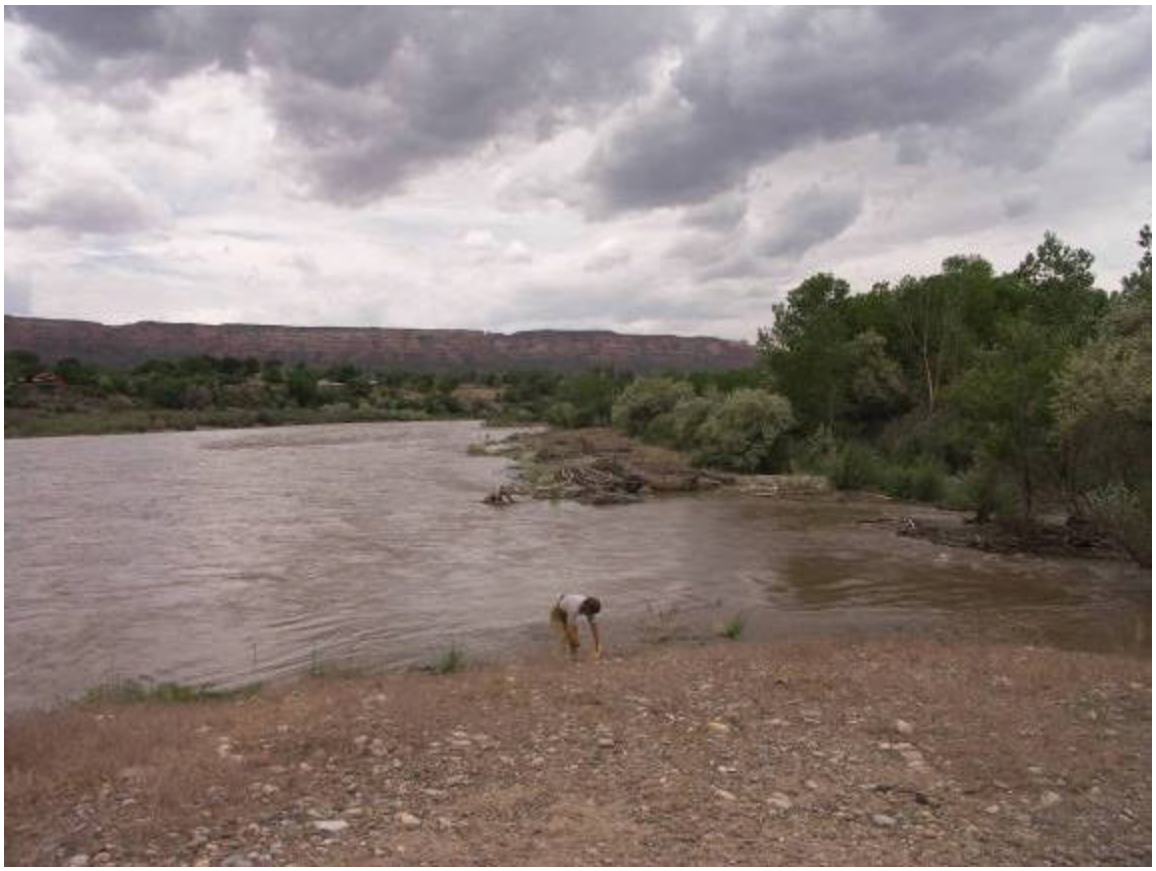
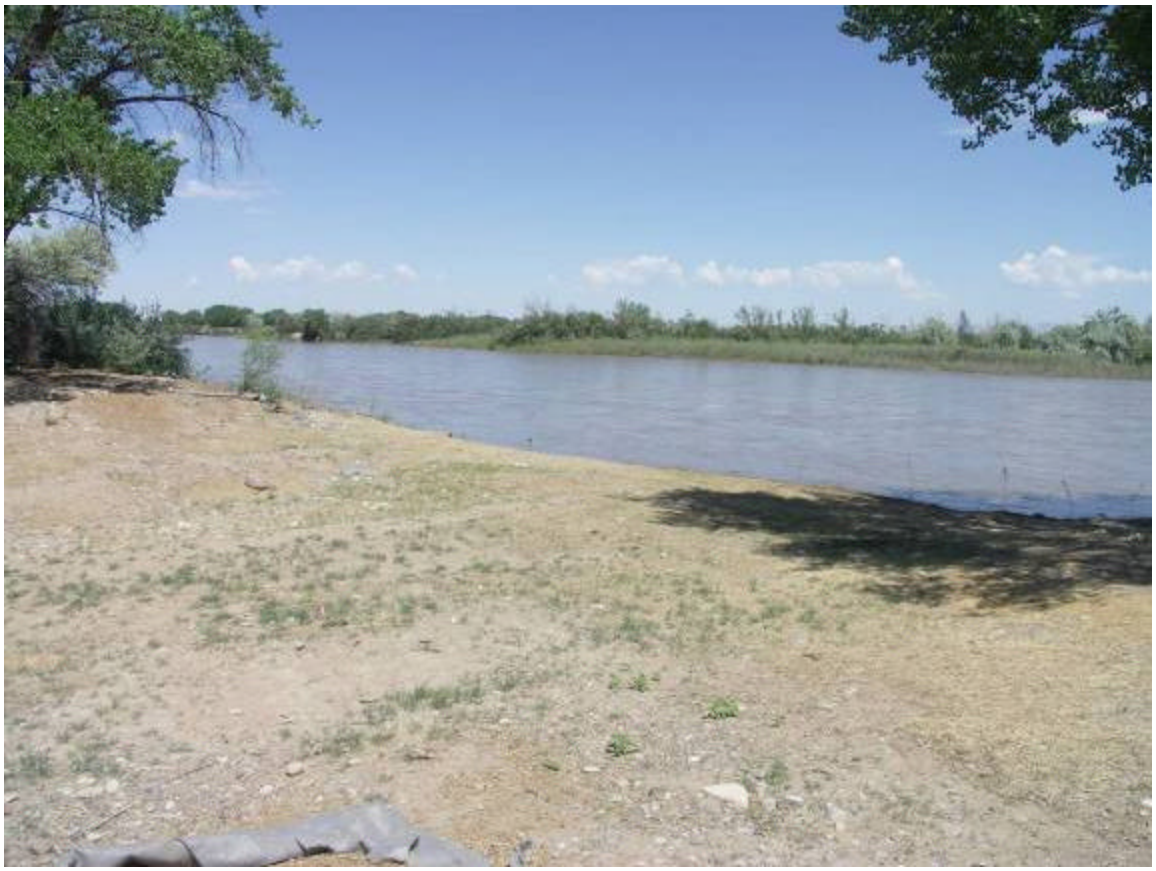


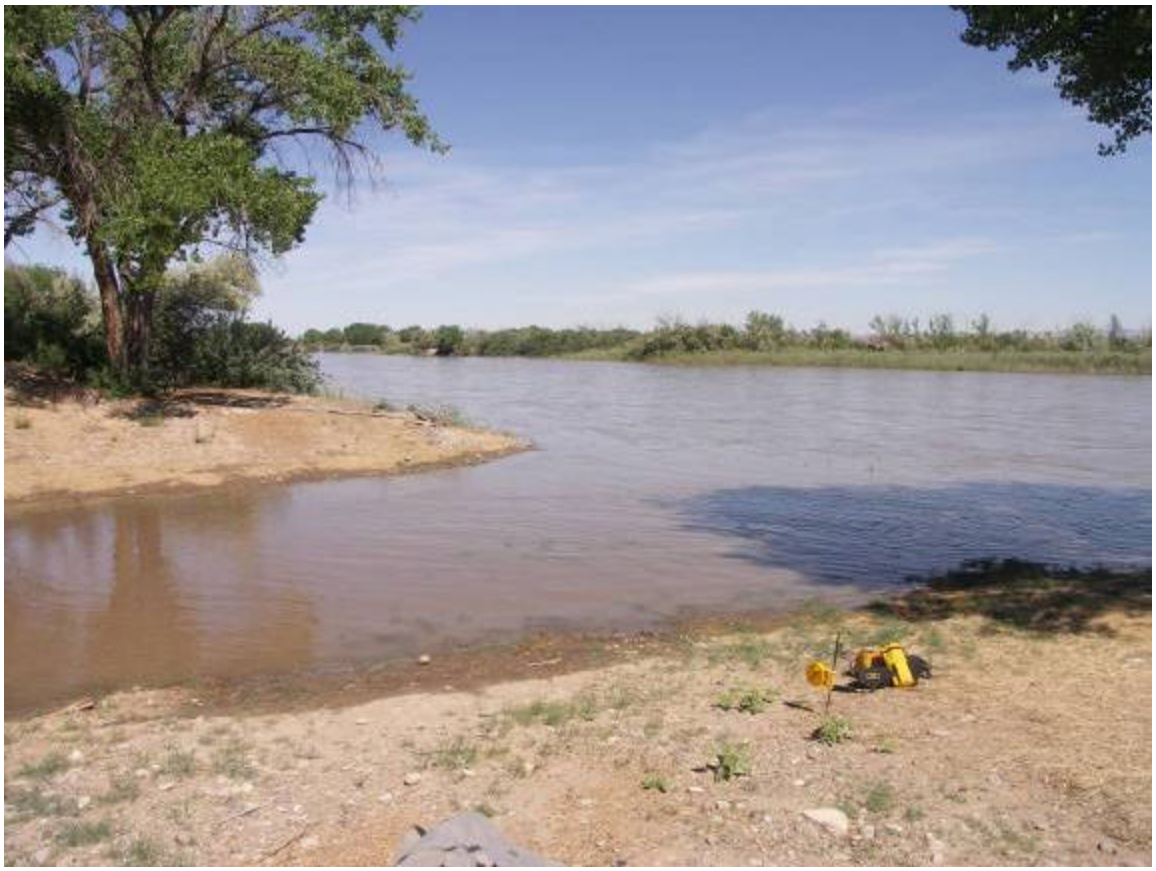
Photo Taken at Walter Walker 5/18/06 (14,300 cfs @ Stateline)
Measurement taken on 5/19/06 (14,400 cfs @ Stateline)
Estimated Discharge from first notch is 168.14 cfs



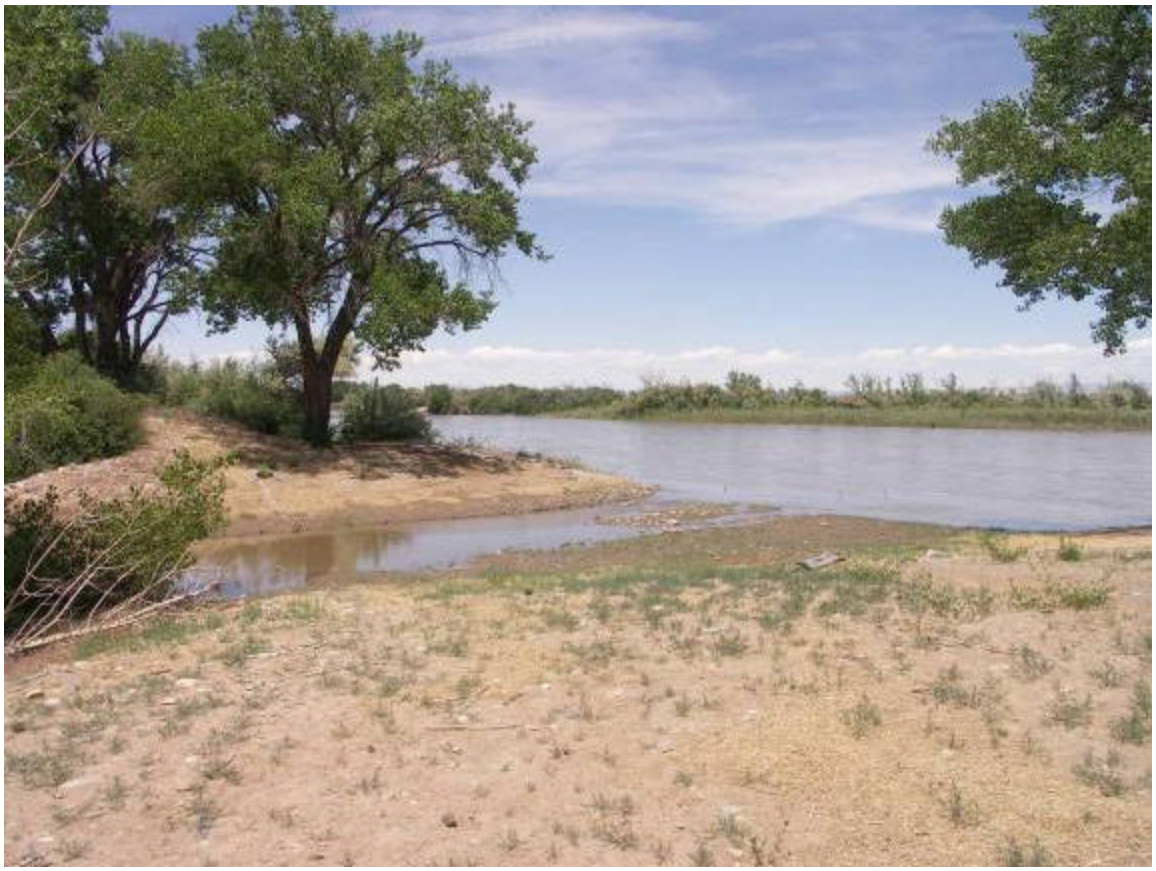
Walter Walker 5/23/06
17,500 cfs at Stateline



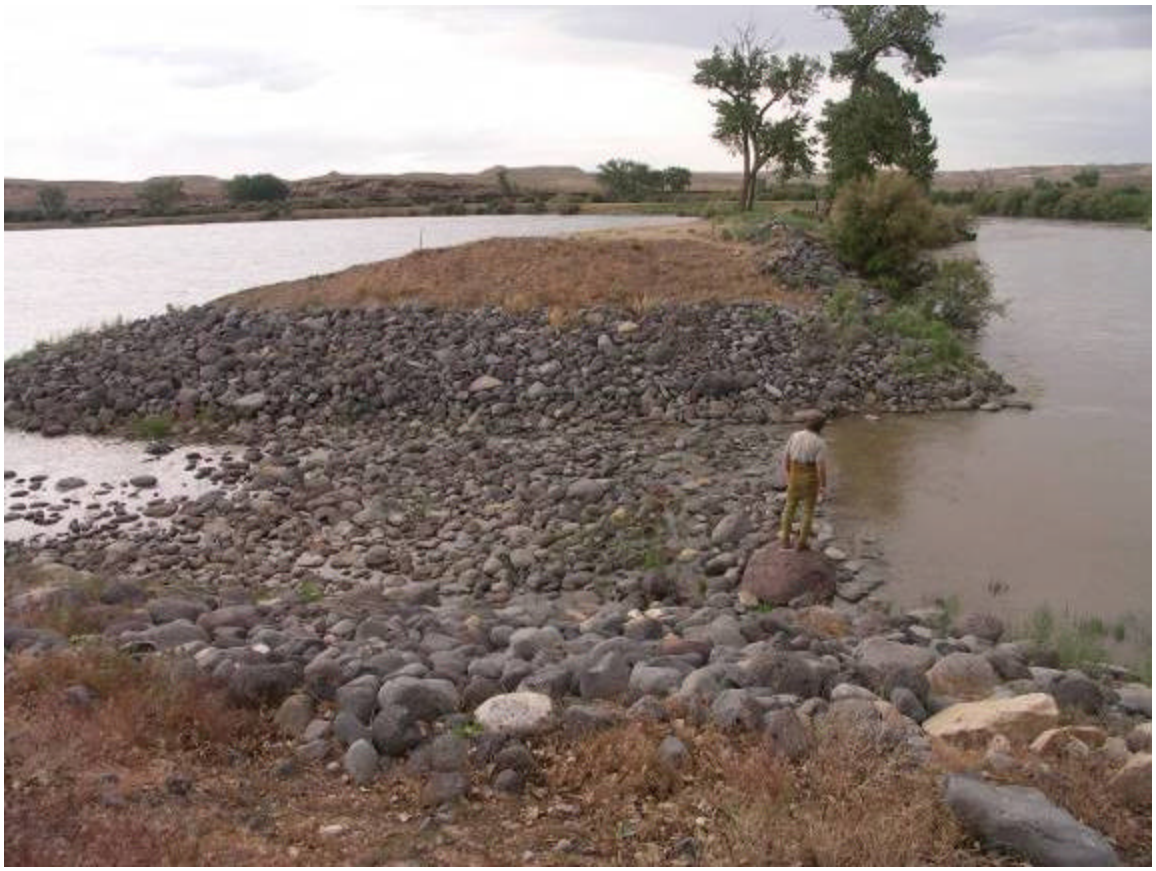
Audubon Site 5/18/06
14,300 cfs @ Stateline



Audubon Site 5/24/06
21,900 cfs @ Stateline



Audubon Site 5/25/06
17,800 cfs @ Stateline



Unaweep (Butch Craig) Site 5/22/06
3,740 cfs @ Whitewater

Table 1-Colorado River 2006 Avg. Daily Spring Peak Flows

Date	Colorado River @ Stateline (cfs)	Audubon Connection >18,000 (cfs)	Walter Walker Connection >13,600 (cfs)	Grand Junction Pipe >37,800 (cfs)
5/1/2006	9750			
5/2/2006	9550			
5/3/2006	9920			
5/4/2006	10800			
5/5/2006	11200			
5/6/2006	11400			
5/7/2006	10500			
5/8/2006	10100			
5/9/2006	9840			
5/10/2006	9700			
5/11/2006	9030			
5/12/2006	8900			
5/13/2006	9000			
5/14/2006	10000			
5/15/2006	11500			
5/16/2006	13200			
5/17/2006	14100		River Connection	
5/18/2006	14500			
5/19/2006	14700			
5/20/2006	15200			
5/21/2006	15700			
5/22/2006	17300			
5/23/2006	19000	River Connection		
5/24/2006	20900			
5/25/2006	18300			
5/26/2006	17800			
5/27/2006	17700			
5/28/2006	17300			
5/29/2006	15700			
5/30/2006	13500			
5/31/2006	11300			

Table 2-Gunnison River 2006 Avg. Daily Spring Peak Flows

Date	Gunnison River @ Whitewater (cfs)	Unaweep Connection >3,700 (cfs)
4/13/2006	3120	
4/14/2006	3750	River Connection
4/15/2006	4810	
4/16/2006	5060	
4/17/2006	4390	
4/18/2006	4510	
4/19/2006	4030	
4/20/2006	3610	
4/21/2006	3610	
4/22/2006	3720	
4/23/2006	4270	River Connection
4/24/2006	5070	
4/25/2006	4590	
4/26/2006	4020	
4/27/2006	4050	
4/28/2006	4220	
4/29/2006	4200	
4/30/2006	3810	
5/1/2006	3430	
5/2/2006	3350	
5/3/2006	3550	
5/4/2006	3710	Connection
5/5/2006	3620	
5/6/2006	3300	
5/7/2006	3000	
5/8/2006	2890	
5/9/2006	2830	
5/10/2006	2680	
5/11/2006	2540	
5/12/2006	2740	
5/13/2006	2920	
5/14/2006	3230	
5/15/2006	3490	
5/16/2006	3770	River Connection
5/17/2006	3800	
5/18/2006	3700	
5/19/2006	3620	
5/20/2006	3640	
5/21/2006	3700	River Connection
5/22/2006	3780	
5/23/2006	4220	
5/24/2006	4020	

5/25/2006	3580	

Walker Walker River Connection Discharge Measurements

Date: 05/19/2006 Time In: 10:15 Time Out: 10:50 Party: Dial

Station (from end)	Width (ft.)	Depth (ft.)	OD		Velocity			Area ($ft.^2$)	Discharge (cfs)
					at point	adj. angle	adjusted		
12	1	0.05	0.6		0.33	1	0.33	0.05	0.0165
14	2	0.4	0.6		0.65	1	0.65	0.8	0.52
16	2	0.5	0.6		0.29	1	0.29	1	0.29
18	2	0.8	0.6		0.13	1	0.13	1.6	0.208
20	2	1.25	0.6		0.81	0.98	0.7838	2.5	1.9845
22	2	1.2	0.6		0.82	0.98	0.8036	2.4	1.92864
24	2	1.7	0.6		0.67	0.92	0.6164	3.4	2.09576
26	2	1.7	0.6		1.04	0.92	0.9568	3.4	3.25312
28	2	2.1	0.6		1.05	0.9	0.945	4.2	3.969
30	3	2.5	0.8	0.73	1.115	0.85	0.94775	7.5	7.108125
			0.2	1.5					
34	4	2	0.6		1.16	0.89	1.0324	8	8.2592
38	4	2	0.6		1.8	0.94	1.692	8	13.536
42	4	2	0.6		1.96	0.97	1.9012	8	15.2096
46	4	1.95	0.6		1.97	0.98	1.9306	7.8	15.05868
50	4	2.2	0.6		2.05	0.99	2.0295	8.8	17.8596
54	3	2.4	0.6		2.02	1	2.02	7.2	14.544
56	2	2	0.6		2.02	1	2.02	4	8.08
58	3	1.5	0.6		2.11	1	2.11	4.5	9.495
62	4	1.3	0.6		1.81	1	1.81	5.2	9.412
66	4	1.3	0.6		1.71	1	1.71	5.2	8.892
70	4	1.5	0.6		1.63	1	1.63	6	9.78
74	4	1	0.6		1.78	1	1.78	4	7.12
78	4	1	0.6		1.22	1	1.22	4	4.88
82	3	0.9	0.6		1.04	1	1.04	2.7	2.808
84	2	0.65	0.6		0.85	1	0.85	1.3	1.105
86	2	0.3	0.6		0.78	1	0.78	0.6	0.468
88	2	0.2	0.6		0.57	1	0.57	0.4	0.228
90	1	0.05	0.6		0.57	1	0.57	0.05	0.0285

Total Discharge = 168.1 cfs

Audubon River Connection Discharge Measurements									
Date: 05/24/2006			Time In: 10:20		Time Out: 11:10			Party: Dial	
Station (from end)	Width (ft.)	Depth (ft.)	OD		Velocity			Area ($ft.^2$)	Discharge (cfs)
					at point	adj. angle	adjusted		
8	1	0.05	0.6		-0.02	1	-0.02	0.05	-0.001
10	2	0.5	0.6		-0.08	1	-0.08	1	-0.08
12	2	1.4	0.6		-0.1	1	-0.1	2.8	-0.28
14	2	2	0.6		0.04	1	0.04	4	0.16
16	2	2.1	0.6		0.33	0.98	0.3234	4.2	1.35828
18	1.5	1.8	0.6		0.63	0.98	0.6174	2.7	1.66698
19	1	1.6	0.6		0.69	0.92	0.6348	1.6	1.01568
20	1.5	1.2	0.6		0.65	0.92	0.598	1.8	1.0764
22	2	0.9	0.6		0.58	0.9	0.522	1.8	0.9396
24	2	1	0.6		0.45	0.85	0.3825	2	0.765
26	2	1.1	0.6		0.4			2.2	0
28	2	0.8	0.6		0.43	0.89	0.3827	1.6	0.61232
30	2	0.9	0.6		0.39	0.94	0.3666	1.8	0.65988
32	2	0.9	0.6		0.2	0.97	0.194	1.8	0.3492
34	3	0.6	0.6		0.08	1	0.08	1.8	0.144
38	4	0.6	0.6		0.05	1	0.05	2.4	0.12
42	4	0.6	0.6		0.06	1	0.06	2.4	0.144
46	3	0.4	0.6		0.04	1	0.04	1.2	0.048
48	1	0.05	0.6		0.01	1	0.01	0.05	0.0005
									Total Discharge = 9.1 cfs

Colorado River Avg. Daily Peak Flows (1951-2006)

Year	Date	Peak (cfs)	Year	Date	Peak (cfs)
1951	6/23/1951	30200	**1995**	6/19/1995	49300
1952	6/9/1952	52000	**1996**	5/20/1996	29100
1953	6/15/1953	37300	**1997**	6/10/1997	37500
1954	5/23/1954	11600	**1998**	5/22/1998	26100
1955	6/10/1955	17100	**1999**	6/1/1999	17900
1956	6/4/1956	28900	**2000**	5/31/2000	17900
1957	6/9/1957	56800	**2001**	5/18/2001	13200
1958	5/31/1958	45000	**2002**	9/12/2002	5520
1959	6/11/1959	23200	**2003**	6/3/2003	26100
1960	6/5/1960	24700	**2004**	5/12/2004	9450
1961	5/31/1961	19300	**2005**	5/25/2005	31000
1962	5/14/1962	40500	**2006**	5/24/2006	20,900
1963	5/20/1963	11300			
1964	5/27/1964	27300			
1965	6/20/1965	36400			
1966	5/11/1966	14400			
1967	5/27/1967	19400			
1968	6/7/1968	26600			
1969	6/26/1969	20400			
1970	5/24/1970	33000			
1971	6/19/1971	22200			
1972	6/9/1972	18400			
1973	6/16/1973	35000			
1974	5/11/1974	22800			
1975	6/9/1975	26300			
1976	6/7/1976	14400			
1977	6/10/1977	5080			
1978	6/17/1978	27800			
1979	5/30/1979	36000			
1980	5/24/1980	32100			
1981	6/9/1981	12100			
1982	6/20/1982	19300			
1983	6/27/1983	62100			
1984	5/27/1984	69800			
1985	5/5/1985	39300			
1986	6/8/1986	33800			
1987	5/18/1987	22500			
1988	5/19/1988	15400			
1989	5/31/1989	9970			
1990	6/12/1990	12600			
1991	6/16/1991	19800			
1992	5/28/1992	16500			
1993	5/28/1993	44300			

Avg Peak	26616.43
Min Peak	5080
Max Peak	69800
Median	23950

Return Period Year*	Stateline Gage (cfs)
1.01	8080
1.11	13600
1.25	16700
2	25300
5	37800
10	46600
25	58100
50	66900
100	76000
500	107000

*1951-1998

1994	5/19/1994	13600

Gunnison River Avg. Daily Spring Peak Flows (1897-2006)

Year	Date	Peak (cfs)	Year	Date	Peak (cfs)	Year	Date	Peak (cfs)
1897	5/9/1897	20700	**1953**	6/14/1953	14100	**1997**	5/26/1997	12900
1898	6/4/1898	11400	**1954**	10/23/1953	4570	**1998**	5/22/1998	10600
1899	5/16/1899	15700	**1955**	5/9/1955	8150	**1999**	5/25/1999	6430
1902	5/12/1902	8460	**1956**	6/3/1956	8670	**2000**	10/4/1999	5770
1903	6/14/1903	17800	**1957**	6/6/1957	27800	**2001**	5/17/2001	5170
1904	5/25/1904	9180	**1958**	5/24/1958	20400	**2002**	9/12/2002	2890
1905	6/9/1905	27400	**1959**	6/15/1959	7160	**2003**	6/2/2003	5990
1906	5/21/1906	21900	**1960**	5/14/1960	9500	**2004**	5/11/2004	3790
1917	6/18/1917	25000	**1961**	5/29/1961	7830	**2005**	5/23/2005	12300
1918	6/14/1918	18000	**1962**	5/13/1962	17000	**2006**	4/16/2006	5060
1919	5/22/1919	11400	**1963**	5/9/1963	4940			
1920	5/23/1920	35700	**1964**	5/27/1964	13600			
1921	6/15/1921	30100	**1965**	5/23/1965	15800			
1922	5/7/1922	22500	**1966**	5/8/1966	5830			
1923	5/28/1923	18400	**1967**	5/26/1967	4900			
1924	5/28/1924	12800	**1968**	5/22/1968	7800			
1925	4/18/1925	9210	**1969**	4/25/1969	12000			
1926	6/7/1926	14200	**1970**	6/29/1970	11500			
1927	5/18/1927	18200	**1971**	5/28/1971	6810			
1928	5/3/1928	21400	**1972**	1/6/1972	5240			
1929	5/26/1929	23100	**1973**	5/19/1973	12000			
1930	5/31/1930	12400	**1974**	5/11/1974	8120			
1931	5/18/1931	3920	**1975**	5/21/1975	9180			
1932	5/23/1932	18500	**1976**	5/17/1976	5380			
1933	6/2/1933	19000	**1977**	7/24/1977	4900			
1934	7/21/1934	4820	**1978**	5/17/1978	8550			
1935	6/15/1935	16400	**1979**	5/29/1979	13500			
1936	5/7/1936	15300	**1980**	5/23/1980	14100			
1937	5/16/1937	15700	**1981**	5/3/1981	4300			
1938	5/31/1938	17600	**1982**	5/5/1982	8460			
1939	5/6/1939	8260	**1983**	6/26/1983	21200			
1940	5/13/1940	9020	**1984**	6/8/1984	26200			
1941	5/14/1941	27500	**1985**	5/5/1985	15800			
1942	5/27/1942	21900	**1986**	5/5/1986	10600			
1943	5/5/1943	13700	**1987**	5/2/1987	9360			
1944	5/17/1944	27200	**1988**	5/18/1988	3720			
1945	5/12/1945	15800	**1989**	4/22/1989	3960			
1946	6/17/1946	10900	**1990**	6/6/1990	2870			
1947	6/22/1947	13900	**1991**	5/22/1991	7620			
1948	5/20/1948	22200	**1992**	5/28/1992	6640			
1949	6/19/1949	19300	**1993**	5/18/1993	21600			

	Flows (cfs)
Avg Peak	13083.78
Min Peak	2870
Max Peak	35700
Median	11750

Return Period Year*	Whitewater Gage (cfs)
1.01	2,270
1.11	4160
1.25	5390
2	8830
5	14500
10	18800
25	24800
50	29700
100	35000

1950	4/24/1950	8240	**1994**	5/20/1994	6290
1951	5/29/1951	9950	**1995**	6/18/1995	18000
1952	5/6/1952	23300	**1996**	5/17/1996	8000

*Post Dam Construction
1975-1999